file - Wyoming Mineral Corp.

ENGINEERING DESCRIPTION

of

THE BY-PRODUCT URANIUM FROM COPPER-PLANT SOLUTIONS PROCESS

Wyoming Mineral Corporation
3900 W. Wadsworth Blvd.
Lakewood, Colorado 80235

Proprietary Class II

3.0 THE PLANT

The Wyoming Mineral Corporation (WMC) plant will remove uranium from a leach solution containing 7.4 ppm U_3O_8 generated by weathering processes at the Kennecott Copper Mine Dumps. Copper values in the leach solution are presently removed by a cementation plant owned by Kennecott Copper Corporation. This plant processes 46,000 gpm, returning processed leach solution to the mine dumps. The WMC plant will process 6,666 gpm of leach solution that has been processed by the cementation plant.[1] After removing the uranium values, the WMC Uranium Recovery Plant will return the leach solution to the cementation plant circuit.

Uranium is removed from the leach solution using a continuous counter current ion exchange system (Higgins loop) followed by a solvent extraction circuit and precipitation of the uranium as ammonium diuranate. The product is a slurry containing 60 to 65% by weight of solids and will be shipped to a uranium mill for custom drying. Estimated recovery of the uranium values is 72.8 percent with the plant producing 350 lbs. of U_3O_8/day.

3.1 EXTERNAL APPEARANCE OF PLANT

An artist's conception and a layout of the plant are given in Figures 3.1-1 and 3.1-2. Table 3.1-1 lists estimated areas and heights for selected structures. The tallest building will house the Higgins loop and will be interconnected with the building housing the solvent extraction process, storage and plant offices. Additional structures will consist of a fire pump house, water tank, sulfuric acid tank, ammonia storage tank and an electrical substation. In addition, a fuel oil storage tank will be constructed on the plant site but will be buried underground. The building will be finished to harmonize with the surroundings.

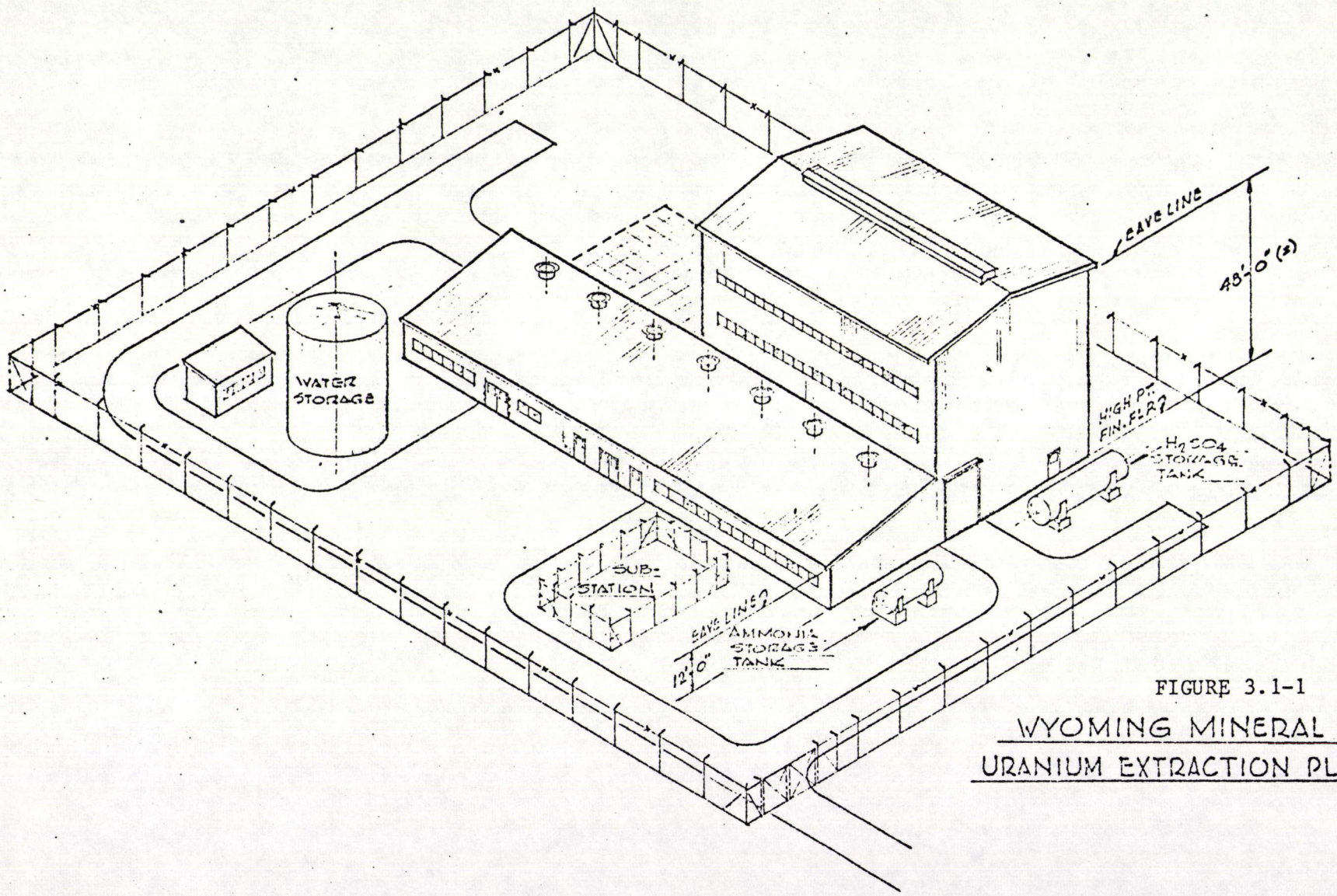


FIGURE 3.1-1

WYOMING MINERAL CORP

URANIUM EXTRACTION PLANT

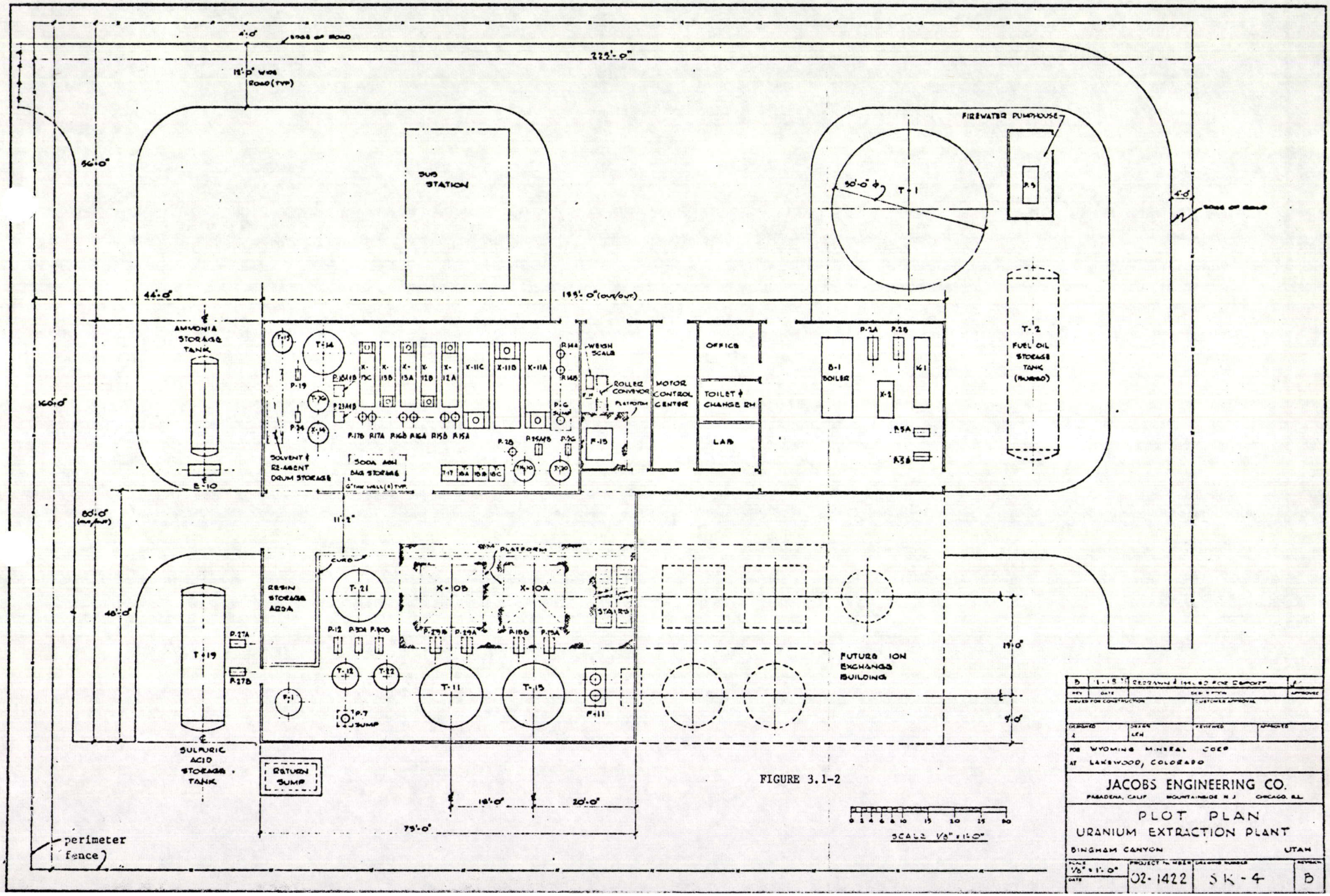


FIGURE 3.1-2

B	1-18-57	REDRAWN & INCLUDED FOR COMPOSIT		
REV	DATE			APPROVED
ISSUED FOR CONSTRUCTION			CUSTOMER APPROVAL	
DESIGNED	DRAWN LEH		REVIEWED	APPROVED

FOR WYOMING MINERAL CORP
AT LAKEWOOD, COLORADO

JACOBS ENGINEERING CO.
PASADENA, CALIF MOUNTAINSIDE N.J CHICAGO, ILL.

PLOT PLAN
URANIUM EXTRACTION PLANT
BINGHAM CANYON UTAH

SCALE	PROJECT NO. NO.	DRAWING NUMBER	REVISION
1/8" = 1'-0"	02-1422	SK-4	B
DATE			

TABLE 3.1-1

ESTIMATED AREA AND HEIGHT OF SELECTED STRUCTURES

	Area	Height
Higgins Loop Section	3460 sq. ft.	48 ft.
Solvent Extraction Section	1920 sq. ft.	12 ft.
Packaging and Drum Storage	400 sq. ft.	12 ft.
Utilities, Office, Lab, etc.	1920 sq. ft.	12 ft.
Fire Pump House	140 sq. ft.	8 ft.
TOTAL	7840 sq. ft.	
Area inside perimeter fence	12544 sq. ft.	

3.2 PLANT CIRCUIT

3.2.1 HIGGINS LOOP

The Higgins loop is a pulsed-bed resin contacting system which simultaneously loads, washes and stirps the resin to recover uranium from the mine dump leach solution (Figure 3.2-1). The selected resin is RIP grade Dowex 21K and has an estimated life of about four years. Two ion exchange units will be used to treat 3333 gpm of feed solution each. Feed solution (7.4 ppm U_3O_8) will flow counter current to the pulsed-bed resin and will contain an estimated 2 ppm U_3O_8 after contact with the resin. After the resin has been loaded with uranium, it is pulsed to transfer it from the loading leg to the stripping leg. In the stripping leg, 3 normal sulfuric acid is used to remove the uranium values from the loaded resin. The stripped resin is then rinsed with water and pulsed back to the loading leg.

3.2.2 SOLVENT EXTRACTION

The sulfuric acid contains 1600 ppm U_3O_8 and is transferred to the solvent extraction operation to further concentrate and purify the uranium. This operation is a conventional mixer-settler type solvent extraction system which uses di-ethyl hexyl phosphoric acid (D2EHPA) reagent with tri-n-octyl phosphine oxide (TOPO) synergistic agent in a kerosene diluent AMSCO-450 as the solvent medium. In the first step of the process the loaded sulfuric acid flows counter current to the D2EHPA/TOPO reagent. The sulfuric acid is stripped of its uranium by the D2EHPA reagent and is returned to the Higgins loop after passing through a solvent recovery unit. The loaded D2EHPA/TOPO reagent is then washed with fresh water to remove any sulfuric acid entrainment.

Step two of the process removes the uranium values from the loaded D2EHPA reagent in three stages with a 10 percent solution of sodium carbonate. The D2EHPA/TOPO reagent is stripped of the uranium and returned to Step 1 of the Solvent Extraction process. The sodium carbonate solution is loaded with uranium and transported to the precipitation process.

3.2.3 PRECIPITATION

In the precipitation process the sodium carbonate solution is acidified with sulfuric acid to eliminate the carbonate. After elimination of the carbonate, the solution flows into a series of three precipitation tanks where anhydrous ammonia is added to precipitate the uranium values as ammonium diuranate.

3.2.4 DEWATERING

The ammonium diuranate slurry flows from the precipitation tanks into a thickener tank with a slow speed rake mechanism. Overflow from the thickener goes into an overflow tank where it is mixed with the feed dump leach water and enters the Higgins loop. The ammonium diuranate underflow is transferred to a repulp tank which is used for additional wash and as a surge for centrifuging. From the repulp tank the ammonium diuranate slurry flows to a small horizontal solid bowl centrifuge. After centrifuging, the ammonium diuranate falls directly into drums for shipment to a drying facility.

3.3 SOURCES OF PLANT WASTES AND EFFLUENTS

Liquid effluents from the WMC plant will be released into the feed solution at an approximate rate of 15.5 gpm (Figure 3.2-1). The liquid released consists of water, $SO_4^{=}$, U_3O_8 and NH_4^{+}.

The waste stream receives water from the Higgins bleed, the Extraction bleed,

the loaded D2EHPA/TOPO reagent wash and from dewatering of the ammonium diuranate. Sulfate enters the waste stream from the solvent extraction bleed, the loaded D2EHPA reagent wash, and from dewatering of the ammonium diuranate. Uranium oxide and ammonium enter the waste stream from dewatering of the ammonium diuranate.

Atmospheric releases consist of CO_2 and releases that arise from the combustion of fuel oil. Carbon dioxide originates from the acidification step in the precipitation process and will be released at a rate of 75 l/min. at standard temperature and pressure. Fuel oil (No. 2 distillate) will be burned to provide steam heat for the facilities and the plant processes. The boiler can produce approximately 4.9 million BTU/hr., but its estimated average usage will be 2 million BTU/hr.

3.4 CONTROLS OF PLANT EFFLUENTS

No treatment of the waste stream will be undertaken because of its small volume (16 gpm) and the very large dilution capacity of the feed solution (6666 gpm)

Discharging the waste stream into the feed solution will pass uranium values of the waste stream through the Higgins loop for greater recovery. Carbon dioxide releases will be vented out of the building. Atmospheric releases from combusted fuel oil will be through an appropriately designed stack. There will be no other gaseous effluents since all processes of the WMC plant occur in covered vessels.

3.5 SANITARY AND OTHER PLANT WASTES

Sewage from the WMC plant will be handled by septic tank and leach field.

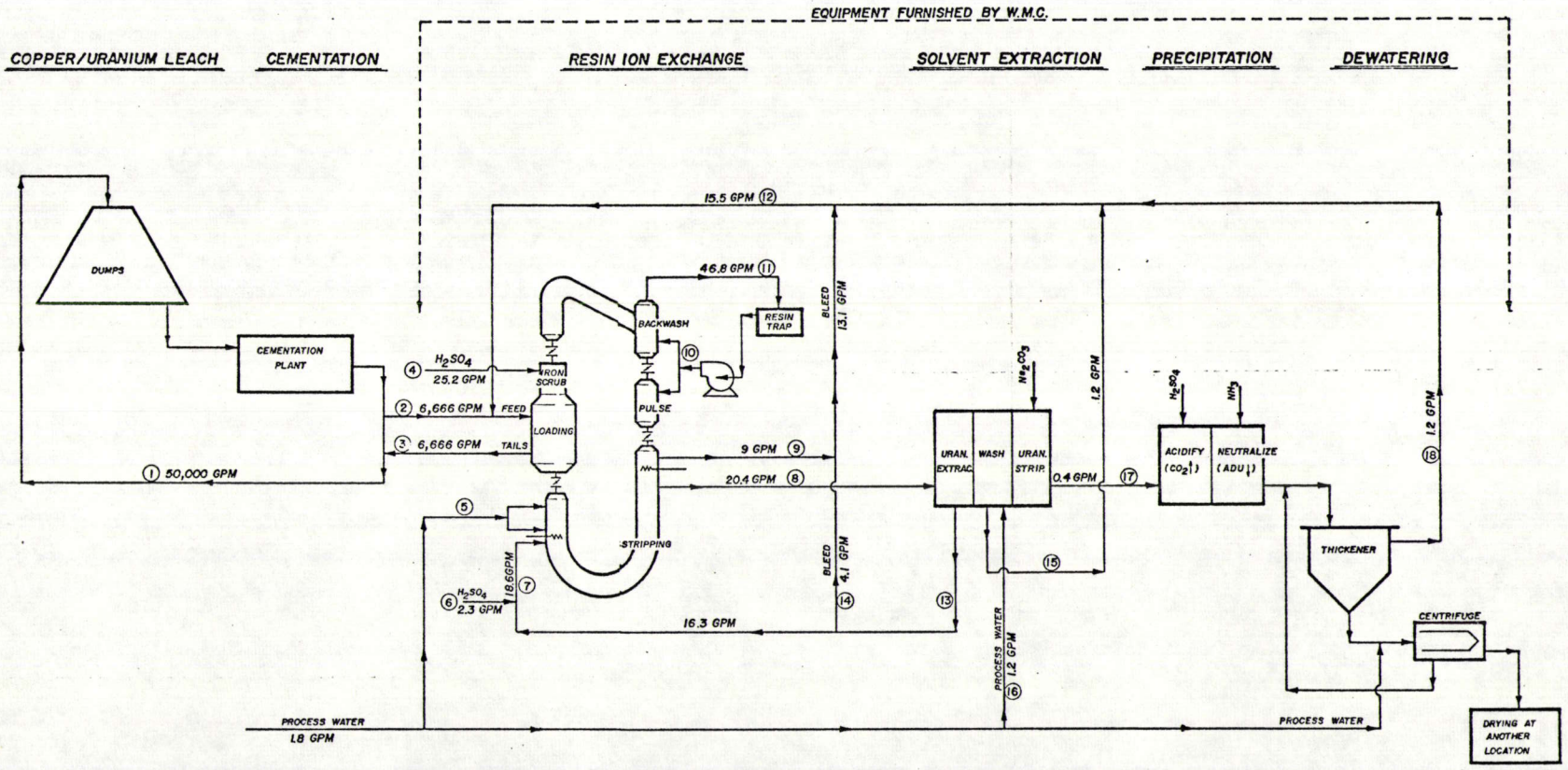
5.0 ENVIRONMENTAL EFFECTS OF PLANT OPERATION (Preliminary Analysis)

The environmental effects from plant operation are considered to be slight. Effluents of the waste stream will have a small environmental impact because of the very large dilution capacity of the feed dump solution.

REFERENCES

3.0

(1) Jacobs Engineering Co., Preliminary Engineering Design and Cost Estimate for Uranium Extraction Plant, Wyoming Mineral Corp., Bingham Canyon, Utah, 1975.



STREAM NO.	DESCRIPTION	FLOW RATE (GPM)	NORMALITY	URANIUM CONC (PPM)	IRON CONC (PPM)
①	PRECIP PLANT TAIL	50,000	——	≈7.5	2,300
②	FEED TO IX UNIT	6,666	——	75	2,300
③	WASTE IX UNIT	6,666	——	2.0	2,000
④	IRON SCRUB	25.2	0.15N	——	——
⑤	RINSE	1.8	——	——	——
⑥	MAKE UP ACID	2.3	3N	——	——
⑦	STRIP SOLUTION	18.6	3N	——	——
⑧	ELUATE	20.4	3N	1,000	50-100
⑨	PRODUCT SLIP	9	≈1.0-2.0N	20-30	1,500-2,000
⑩	BACKWASH & PULSE	55.8	——	——	——
⑪	BACKWASH	46.8	——	5-10	——
⑫	BLEED STREAM	15.5	≈2-3N	——	——

STREAM NO.	DESCRIPTION	FLOW RATE (GPM)	NORMALITY	URANIUM CONC (PPM)	IRON CONC (PPM)
⑬	BARREN FROM SX	20.4	≈3N	10.0	20-40
⑭	BLEED	4.1	3N	10.0	20-40
⑮	WASTE WATER	1.2	——	——	——
⑯	WASH WATER	1.2	——	——	——
⑰	PREGNANT SOL.	0.4	1N	40,000	——
⑱	SUPER-NATE	1.2	——	——	——

FIG 3.2-1

WYOMING MINERAL CORPORATION

PROCESS FLOW SHEET
BY-PRODUCT URANIUM
FROM COPPER-PLANT SOLUTIONS

DWN: DJC	12-22-75	CSM 300	REV.
CHKD:			
APRD:			
SCALE:		SHEET OF	

WMC LICENSING MILESTONES FOR KENNECOTT PLANT

Milestone	Responsibility	Date
NRC Meeting	W. Ford	2/11/76
Utah State Agency Meeting	W. Ford	2/25/76
Kennecott Information Obtained	W. Ford - J. Brooke	2/76
Consultants Identified	W. Ford	2/76
Kennecott Site Selected	J. Brooke	3/76
Consultant Preliminary Survey Completed	W. Ford	4/76
NRC Construction Application with Preliminary Environmental Survey	W. Ford	5/76
Utah Oil & Gas Division Application	W. Ford	5/76
Utah Board of Health Air Application	W. Ford	5/76
Utah Board of Health Septic Application	W. Ford	5/76
Consultant Detailed Environmental Survey Completed	W. Ford	6/76
NRC Operations Application with Detailed Environmental Survey	W. Ford	8/76
Start Construction	J. Brooke	10/76
Start Operation	J. Brooke	5/77

by _____ Date _____

W. H. Ford, Engineer
Licensing and Safety

Approved by _____ Date _____

James N. Brooke, Project Manager
Alternate Sources